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Before the
Federal Communications Commission
Washington DC 20554

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DEC 19 1994

In the Matter of)
)
Allocation of Spectrum Below)
5 GHz Transferred From)
Federal Government Use)

ET Docket No. 94-32

TO: The Commission

COMMENTS OF SYMBOL TECHNOLOGIES, INC.

1. Symbol Technologies, Inc. ("Symbol"), a major manufacturer of Part 15 spread spectrum data communications equipment, hereby submits these Comments in response to the Notice of Proposed Rule Making in the above-captioned proceeding.^{1/} The Notice seeks comment on the allocation of certain frequency bands, including 2402-2417 MHz.

2. Symbol opposes the Commission's proposal to eliminate Part 15 operations from the 2402-2417 MHz band as contrary to the public interest and supports the alternative proposal to limit licensed services to protect Part 15. Symbol disfavors the intermediate proposal, under which licensed services and Part 15 would coexist in the band, because the Commission's reluctance to specify technical parameters for licensed services would make the band a treacherous environment for low-power operation. If the Commission is inclined to require coexistence, however, Symbol urges at a minimum that Part 15 operations be protected by (a) prohibiting high-powered, wideband transmitters in the 2402-2417 MHz band, and (b) deeming a properly certified Part 15

^{1/} Allocation of Spectrum Below 5 GHz, ET Docket No. 94-32, Notice of Proposed Rule Making, FCC 94-272 (released Nov. 8, 1994) ("Notice").

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device not to be a source of harmful interference to a licensed user.^{2/}

A. SPREAD SPECTRUM OPERATIONS IN THE 2400-2483.5 MHz BAND ARE IN THE PUBLIC INTEREST.

3. One of the frequency ranges at issue in this proceeding, 2402-2417 MHz, is part of the 2400-2483.5 MHz band, in which Part 15 spread spectrum operations are currently authorized.^{3/} Since its inception,^{4/} and especially in recent years, spread spectrum technology has proved to be an unqualified success in a wide variety of applications. Typical commercial applications include retail pricing, inventory control, and incoming receiving control; warehousing and distribution; tracking of raw materials, work in progress, and finished goods in manufacturing, as well as inventory control, production tracking, and quality assurance reporting; and tracking of shipments by package and parcel delivery providers, passenger airlines, the US Postal Service, and freight trucking. These systems automate tasks in real time, provide dramatic speed improvements, and increase accuracy.

^{2/} On December 6, 1994, Symbol filed a Petition for Rule Making that seeks certain changes in the technical rules governing spread spectrum operations at 2400-2483.5 and 5725-5850 MHz. Among other advantages, the requested changes will facilitate interoperability between spread spectrum and licensed applications by enabling spread spectrum users to avoid 2402-2417 MHz altogether while still maintaining an adequate bandwidth. Symbol would have no objection to any licensed service in the band if the requested rule changes were in place over 2402-2417 MHz.

^{3/} 47 C.F.R. § 15.247. The band is also shared by Government radiolocation services, ISM equipment, and the Amateur Radio Service. See 47 C.F.R. §§ 2.106, 18.301, 97.301.

^{4/} Spread Spectrum Systems, 101 F.C.C.2d 419 (1985). See also Spread Spectrum Systems, 5 FCC Rcd 4123 2 (1990).

4. Symbol is the leading manufacturer of portable bar code driven data transaction systems, with 2.5 million scanners and hand-held computers installed. Symbol designs, manufactures, and markets bar code laser scanners, portable computers, and spread spectrum data communications networks that are used as strategic building blocks in technology systems for the industries listed above. Symbol's products include the "Spectrum One" network, a real time data collection system that uses Part 15 spread spectrum transmission. Spectrum One and products that communicate over the network constitute the fastest growing segment of the retail automation market. More than 50% of all new installations of wireless data collection systems are based on spread spectrum technology. Such systems using relatively high data rates, as opposed to the lower data rates available on narrowband licensed channels, have revolutionized this industry.

5. Other spread spectrum applications will soon eliminate check-out lines in supermarkets and discount stores by letting customers scan their own purchases in the aisle. The same technology is also helping the health care industry to improve performance and hold down costs: With bar-coded patient ID bracelets, a hospital-wide system can track inventory, create accurate and current patients' bills, and even verify the timing and dosage of medications at the bedside. Spread spectrum systems are also widely used for intracity data relay and are especially valuable where spectrum for more conventional technologies, such as microwave, is congested or unavailable.

6. Commercial users have invested over \$500 million in spread spectrum radio products for data collection, such as those manufactured by Symbol, with a current annual growth rate of between 30 and 50 percent.^{5/} Utility companies will soon have invested almost a billion dollars in spread spectrum automatic meter reading equipment.^{6/} Although many such applications are invisible to consumers, their impact nonetheless shows up in the form of lower prices and in the United States' competitive edge in global markets. In addition, there is a burgeoning market for spread spectrum consumer products, including such devices as cordless telephones, wireless speakers, wireless headsets, wireless VCR-to-TV transmission, and long-range remote controls.^{7/}

7. The advantages of this technology will soon come to wireless high-speed computer networks ("wireless LANs"). The

^{5/} These figures are computed from Symbol's own sales divided by its market share as published in industry references. The figures do not include expenditures for related computer hardware, software, and training. If taken into account, these would increase the total approximately tenfold.

^{6/} This information comes from a survey of gas and electric companies conducted by the Utilities Telecommunications Council. The 45 responding companies represent only a fraction of the gas and electric utilities providing service to the public nationwide, so the true total may be much larger. (Data provided by Utilities Telecommunications Council on Nov. 17, 1994.)

^{7/} Many of the applications described in text presently operate in the 902-928 MHz band. As the Commission acknowledges, however, "many of the companies currently manufacturing unlicensed Part 15 equipment for the 902-928 MHz band have begun to develop or modify this equipment for use at 2400-2483.5 MHz and several firms are selling devices for use in this band." Notice at ¶ 18. A survey of the FCC's recent public notices shows a sharp upturn in certification grants for 2.4 GHz equipment, which presages greatly increased activity at 2.4 GHz.

Institute of Electrical and Electronic Engineers ("IEEE") is sponsoring an industry-wide standard (IEEE 802.11) for wireless LANs using spread spectrum in the 2400-2483.5 MHz band. Several major computer and communications manufacturers, including Apple Computer, AT&T, GEC-Plessey, IBM, Motorola, Raytheon, and Symbol, are playing lead roles in these deliberations. Adoption of the standard is expected in 1995, and will greatly accelerate the demand for wireless spread spectrum communications at 2400-2483.5 MHz. The earlier IEEE standards for wired local area networks -- 802.3 (Ethernet) and 802.5 (Token Ring) -- have had strong economic effects, producing tens of billions of dollars in investment and revenue and creating several large companies to serve the emerging markets, including Novell, 3COM, Cisco, and Synoptics. There is every reason to expect that IEEE 802.11 will have comparable effects on the market for wireless LANs. A well-respected trade publication projects the following growth for wireless LANs:^{8/}

	Revenue (millions)	Growth (percent)
1993	\$100.7	127.8%
1994	206.1	104.7
1995	359.7	74.5
1996	565.3	57.2
1997	836.9	48.0
1998	1,155.9	38.1
1999	1,522.1	31.7
2000	1,923.1	26.3

The implementation of IEEE 802.11 not only will make spread spectrum operations at 2400-2483.5 MHz a major industry in itself

^{8/} Plessey makes leap with wireless LAN, Electronic Engineering Times, Issue 822 at 1 (Nov. 7, 1994).

but will also make spread spectrum radio -- like wired LANs today -- the communications backbone for countless businesses of every description.

B. THE COMMISSION SHOULD PROTECT SPREAD SPECTRUM OPERATIONS IN THE 2402-2417 MHz BAND.

8. The Commission has declined to specify particular uses for 2402-2417 MHz. Instead it proposes "a flexible allocation that relies substantially on market forces" by auctioning the spectrum and allowing successful bidders to use it for purposes of their own choosing.^{9/} In addition, the Commission proposes to refrain from establishing technical standards, and would let users choose even such key parameters as signal strength, channelization, modulation techniques, and antenna characteristics.^{10/} The only Commission-imposed technical constraints would be those governing interference to other users, including those in adjacent service areas.^{11/}

9. At the same time, however, the Commission acknowledges that the growing demand for Part 15 equipment at 2.4 GHz makes 2402-2417 MHz "a particularly challenging environment" for new radio services.^{12/} Foreseeing potential incompatibilities

^{9/} Notice at ¶ 9. At 2402-2417 MHz, the only proposed use different from Part 15 applications is mobile satellite service ("MSS") -- with the caveat that MSS providers are pessimistic about the utility of this band. Id. at ¶ 19.

^{10/} Id. at ¶ 10.

^{11/} Id. As discussed below, the category of protected users does not necessarily include Part 15 spread spectrum users.

^{12/} Id. at ¶ 18.

between Part 15 and the as-yet-unknown licensed services, the Commission lays out three alternatives: abolish Part 15 from the band; maintain both Part 15 and licensed users; or maintain Part 15 while limiting licensed applications.^{13/}

10. The first option -- eliminating Part 15 -- is demonstrably contrary to the public interest. Part 15 spread spectrum operations are one of the Commission's success stories. Well-engineered Part 15 devices retain the ability to boost users' productivity even amid high levels of ambient radio noise. The marketplace has enthusiastically embraced this technology, as described in Part A above. Users particularly appreciate the "plug-and-play" characteristics of Part 15: Equipment can be installed, moved, or replaced with none of the paperwork and delays that affect the licensed services.

11. The ability of diverse users to coexist under the Part 15 regulatory scheme has also advanced the Commission's own goals. This industry is regulated by the marketplace, not the Commission. The only regulatory burden is the straightforward process of equipment certification. There is no need for the Commission to grant and renew licenses, maintain license databases, or resolve quarrels among licensees. Perhaps most important, equipment and services can respond quickly to customers' changing needs. Even a radical technological advance can reach the marketplace quickly, without the lengthy delays required for a Commission rule making. Manufacturers can introduce innovative

^{13/} Id.

technologies as fast as they can obtain certifications; and providers can offer new services as fast as the equipment comes on the market. The Part 15 regulatory environment leaves development and deployment decisions where they belong, in the hands of the users, while maximizing the use of spectrum to the benefit of all.

12. For all of these reasons, the Commission's third alternative -- that of limiting licensed use of the band in favor of Part 15 -- is in the public interest. While recognizing that political pressure may be brought to bear for coexistence between Part 15 and licensed services, Symbol opposes that approach largely because of the uncertainties engendered by an absence of technical standards. If the Commission ultimately favors this option, however, Symbol urges two caveats. First, although spread spectrum receivers are very tolerant of incoming narrow-band interference, they can be susceptible to high-powered wideband sources. The Commission should acknowledge that transmitters operating in the tens or hundreds of watts, with bandwidths on the order of 1 MHz or more, may threaten ongoing spread spectrum operations at 2402-2417 MHz, and should prohibit such equipment. Second, the Commission should deem a properly certified Part 15 device not to be a source of harmful interference in the 2402-2417 MHz band.

13. This second point is necessary because some licensed services employing exceptionally sensitive receivers can be vulnerable to interference from nearby Part 15 transmitters; and

Section 15.5(c) of the Commission's Rules can require a Part 15 user to cease operations if it causes harmful interference to a licensed service. To the best of Symbol's knowledge this provision has never been invoked, and the few known cases of interference from Part 15 to other services have been resolved amicably. Nevertheless, the extraordinarily wide technical latitude proposed for 2402-2417 MHz band puts spread spectrum operations at risk. Regardless of whether it actually materializes, the mere existence of that risk will deter the deployment of spread spectrum systems, even where they would otherwise be the optimum choice.^{14/}

14. Symbol proposes that the Commission resolve this dilemma by deeming Part 15 devices not to be a source of harmful interference. No doubt the vast majority of interference incidents would continue to be resolved by the parties themselves. But such a ruling would put licensed users on notice of a minimal "noise floor" for their receivers, and so would protect Part 15 users from arbitrary application of Section 15.5. Experience in the 902-928 MHz band suggests that this proposal will not significantly burden technical innovation at 2402-2417 MHz.

CONCLUSION

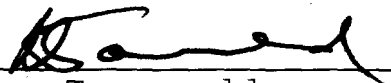
The economic activity deriving from Part 15 spread spectrum operations, already substantial, will grow dramatically with


^{14/} Although Part 15 operations are secondary to licensed services, the continuing viability of Part 15 is a public interest factor the Commission must consider in deciding whether and how to license new services. See 47 U.S.C. § 303.

adoption of the IEEE's standard for wireless LANs at 2400-2483.5 MHz. The Commission should not eliminate Part 15 from the 2402-2417 MHz band, but to the contrary should limit any licensed services in the band to protect Part 15 operations. If the Commission decides that Part 15 and licensed users must share the band, then at a minimum it should offer Part 15 the degree of protection afforded by prohibiting high-powered, wideband licensed transmitters and by deeming a certified Part 15 device not to be a source of harmful interference.

Respectfully submitted,

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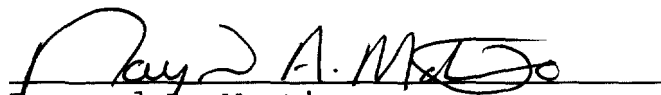

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December 19, 1994

VERIFICATION

I have read the foregoing Comments of Symbol Technologies, Inc. I declare under penalty of perjury that the facts stated therein are true and correct to the best of my knowledge and belief. Executed on December 16, 1994.

A handwritten signature in dark ink, appearing to read "Ray A. Martino", is written over a horizontal line.

Raymond A. Martino
Director of RF Engineering
Symbol Technologies, Inc.